

CLAIMS

What is claimed is:

1. A manufacturing method of carbon nanotube transistors, comprising the steps of:

forming an insulating layer on a substrate;

5 forming a first oxide layer on the insulating layer by the spin-on-glass (SOG) method;

forming a second oxide layer on the first oxide layer by the SOG method;

forming a blind hole on the second oxide layer by exposing, developing, and etching, the blind hole exposing the insulating layer, the first oxide layer, and
10 the sidewall of the second oxide layer;

forming a carbon nanotube inside the blind hole, both ends of the carbon nanotube connecting to the opposite sidewalls of the first oxide layer; and

forming a source and a drain on the second oxide layer, the source and the drain being separated by the blind hole and connecting to the two ends of the
15 carbon nanotube, respectively.
2. The manufacturing method of claim 1, wherein the insulating layer is comprised of a chemical selected from SiO_2 and Si_xN_y .
3. The manufacturing method of claim 1, wherein the insulating layer is formed by chemical vapor deposition (CVD).
- 20 4. The manufacturing method of claim 1, wherein the means of forming the first oxide layer includes the steps of: preparing a first oxide layer coating solution, applying the first oxide layer coating solution on the substrate by the SOG method, and drying the applied first oxide layer coating solution.

5. The manufacturing method of claim 4, wherein the first oxide layer coating solution comprises at least a solution containing TEOS, pure alcohol and catalyst ions.
6. The manufacturing method of claim 5, wherein the catalyst ions are selected from the group consisting of iron ions, cobalt ions, and nickel ions.
- 5 7. The manufacturing method of claim 5 further comprising an ammonia solution.
8. The manufacturing method of claim 1, wherein the means of forming the second oxide layer includes the steps of: preparing a second oxide layer coating solution, applying the second oxide layer coating solution on the substrate by the SOG method, and drying the applied second oxide layer coating solution.
- 10 9. The manufacturing method of claim 8, wherein the second oxide coating solution comprises at least TEOS.
10. The manufacturing method of claim 1, wherein the means of forming the carbon nanotube includes the steps of: using the alcohol inside the first oxide layer as a reactant to react with the catalyst ions inside the first oxide layer at a temperature of 850°C.
- 15 11. A manufacturing method of carbon nanotube transistors, comprising the steps of:
- forming an insulating layer on a substrate;
- forming a source and a drain, separated by a gap, on the first insulating layer;
- forming a first oxide layer on the source and the drain by the spin-on-glass (SOG) method;
- 20 forming a second oxide layer on the first oxide layer by the SOG method;
- forming a blind hole on the second oxide layer by exposing, developing, and etching, the blind hole exposing the insulating layer, the sidewalls of the source and the drain, the first oxide layer, and the sidewall of the second oxide layer;

forming a carbon nanotube inside the blind hole, both ends of the carbon nanotube connecting to the opposite sidewalls of the first oxide layer; and

forming a second insulating layer on the second oxide layer that contains the blind hole.

5 12. The manufacturing method of claim 11, wherein the second insulating layer presses the carbon nanotube down so that its both ends touch the source and the drain, respectively.

10 13. The manufacturing method of claim 11, wherein the means of forming a first oxide layer includes the steps of: preparing a first oxide layer coating solution, applying the first oxide layer coating solution on the substrate by the SOG method, and drying the applied first oxide layer coating solution.

14. The manufacturing method of claim 13, wherein the first oxide layer coating solution comprises at least a solution containing TEOS, pure alcohol and catalyst ions.

15 15. The manufacturing method of claim 14, wherein the catalyst ions are selected from the group consisting of iron ions, cobalt ions, and nickel ions.

16. The manufacturing method of claim 11, wherein the means of forming the carbon nanotube includes the steps of: using the alcohol inside the first oxide layer as a reactant to react with the catalyst ions inside the first oxide layer at a temperature of 850°C.

20 17. A manufacturing method of carbon nanotube transistors, comprising the steps of:
forming an insulating layer on a substrate;
forming a source and a drain, separated by a gap, on the first insulating layer;
forming a first oxide layer on the source and the drain by the spin-on-glass (SOG) method;

forming a second oxide layer on the first oxide layer by the SOG method;

forming a blind hole on the second oxide layer by exposing, developing, and etching, the blind hole exposing the insulating layer, the sidewalls of the source and the drain, the first oxide layer, and the sidewall of the second oxide layer, and the source and the drain protruding from the sidewalls of the first oxide layer and the second oxide layer; and

forming a carbon nanotube inside the blind hole, the carbon nanotube connecting to the opposite sidewalls of the first oxide layer separated by the blind hole and both ends of the carbon nanotube connecting the surfaces of the source and the drain, respectively.

18. The manufacturing method of claim 17, wherein the means of forming a first oxide layer includes the steps of: preparing a first oxide layer coating solution, applying the first oxide layer coating solution on the substrate by the SOG method, and drying the applied first oxide layer coating solution.

19. The manufacturing method of claim 18, wherein the first oxide coating solution comprises at least a solution containing TEOS, pure alcohol and catalyst ions.

20. The manufacturing method of claim 19, wherein the catalyst ions are selected from the group consisting of iron ions, cobalt ions, and nickel ions.

21. The manufacturing method of claim 17, wherein the means of forming the carbon nanotube includes the steps of: using the alcohol inside the first oxide layer as a reactant to react with the catalyst ions inside the first oxide layer at a temperature of 850°C.

22. A manufacturing method of carbon nanotube transistors, comprising the steps of:

forming a first insulating layer on a substrate;

forming a first oxide layer on the first insulating layer by the spin-on-glass

(SOG) method;

forming a second oxide layer on the first oxide layer by the SOG method;

forming a blind hole on the second oxide layer by exposing, developing, and etching, the blind hole exposing the first insulating layer, the first oxide layer, and the sidewall of the second oxide layer;

forming a carbon nanotube inside the blind hole, both ends of the carbon nanotube connecting to the opposite sidewalls of the first oxide layer;

forming a second insulating layer on the second oxide layer that contains the blind hole, the second insulating layer covering the carbon nanotube;

forming a photoresist pattern at the blind hole by exposing and developing, covering the blind hole and part of the second insulating layer;

removing the area that is not covered by the photoresist pattern by etching to form a second insulating layer protruding part and exposing the carbon nanotube by the second insulating layer protruding part; and

forming a source and a drain, separated by the second insulating layer protruding part, on the first oxide, connecting to the carbon nanotube exposed by the second insulating layer protruding part.

23. The manufacturing method of claim 22, wherein the means of forming a first oxide layer includes the steps of: preparing a first oxide coating solution, applying the first oxide layer coating solution on the substrate by the SOG method, and drying the applied first oxide layer coating solution.

24. The manufacturing method of claim 23, wherein the first oxide layer coating solution comprises at least a solution containing TEOS, pure alcohol and catalyst ions.

25. The manufacturing method of claim 24, wherein the catalyst ions are selected from the group consisting of iron ions, cobalt ions, and nickel ions.

26. The manufacturing method of claim 22, wherein the means of forming the carbon nanotube includes the steps of: using the alcohol inside the first oxide layer as a reactant to
5 react with the catalyst ions inside the first oxide layer at a temperature of 850°C.